Cyfoeth Naturiol Cymru
Natural Resources Wales

The current status and distribution of the beetles *Anthonomus conspersus*, *Aulacobaris lepidii* and *Thinobius newberyi* on selected Welsh SSSIs in 2018

Adrian Fowles

NRW Evidence Report No. 297

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1. Crynodeb Gweithredol

Mae'r tair rhywogaeth a ddewiswyd ar gyfer y cytundeb hwn i gyd yn nodweddion cymwys unigol o ran eu priod Safleoedd o Ddiddordeb Gwyddonol Arbennig (SoDdGAau), eto, nid oeddent wedi cael eu cofnodi ar y SoDdGAau hynny am o leiaf 20 mlynedd. Nid oes unrhyw dystiolaeth i ddangos bod chwiliadau ar gyfer *Anthonomus conspersus* neu *Aulacobaris lepidii* wedi cael eu cynnal yn y cyfamser ac er bod rhywfaint o ymdrechion i gynnal arolygon yn 2004 a allai fod wedi cynhyrchu cofnodion ynglŷn â *Thinobius newberyi*, mae hon yn rhywogaeth anodd ei chanfod. Gan fod cyflwr cynefin y tair rhywogaeth wedi parhau i fod yn addas yn ôl pob golwg nid oedd unrhyw reswm i dybio bod unrhyw un o'u poblogaethau wedi darfod. Fodd bynnag, dros gyfnod o amser mor hir, byddai cadarnhad o'u presenoldeb parhaus yn amlwg yn ddymunol.

Canfuwyd bod y gwiddonyn *A. conspersus* wedi sefydlu'n gadarn yng Nghoed Boch y Rhaeadr yn Safle o Ddiddordeb Gwyddonol Arbennig Migneint-Arenig-Dduallt, lle cofnodwyd oedolion trwy'r coetir ac ar y ffridd gyferbyn. Yn hanesyddol mae'n debygol bod yr ardal wedi'i rheoli fel coetir pori ac mae nifer o goed criafol hynafol yn wasgaredig drwy rannau mwyaf coediog y safle, yn ogystal â llechwedd agored y bryn. Nid oedd yn bosib cynnal arolwg manwl o'r adnodd coed o fewn yr amser oedd ar gael, ond mae brasamcan yn awgrymu bod mwy na 300 o goed yn bresennol. Darperir map o'r crynodiadau mwy dwys. Am o leiaf 20 mlynedd, mae stociau pori wedi'u ffensio y tu allan i'r coetir fel rhan o gynllun amaeth-amgylcheddol ac mae hyn wedi arwain at gynnydd mewn prysgwydd bedw ar y llethrau is. Ar hyn o bryd mae llanerchau digonol i ddarparu amodau addas ar gyfer *A. conspersus* ond dylid rhoi ystyriaeth i rywfaint o waith rheoli er mwyn cadw'r mannau agored hyn yn y coetir.

Cofnodwyd y gwiddonyn *A. lepidii* ddwywaith ar ystumiau'r Afon Dyfrdwy yn Safle o Ddiddordeb Gwyddonol Arbennig Afon Dyfrdwy yn y 1990au ond nid yw wedi'i weld ers hynny. Dewiswyd pum safle i'w harolygu o ffotograffau o'r awyr lle'r oedd tywod a graean agored i'w gweld yn amlwg ar lannau'r afon, gan fod *A. lepidii* yn bridio ymysg gwreiddiau planhigion croesffurf sy'n tyfu mewn gwaddodion tywodlyd. Ymwelwyd â dau safle ychwanegol y nodwyd eu bod yn cynnwys cynefinoedd posib yn ystod arolwg blaenorol. Ni ddaethpwyd o hyd i'r rhywogaeth yn ystod un o'r arolygon hyn a chafwyd olyniaeth llystyfiant yn y ddau safle a argymhellwyd fel nad oedd llawer o dywod agored, os o gwbl, i'w weld. Roedd planhigion cynhaliol y gwiddonyn yn brin yn gyffredinol ar y safleoedd sy'n weddill ac ym mhedwar o'r pum safle roedd ôl sathru gan dda byw yn amlwg, ac roedd planhigion croesffurf cynhaliol wedi'u pori'n drwm. Mae'n debygol bod *A. lepidii* yn dal i fod yn bresennol ar hyd y rhan hon o'r afon ond mae'r aflonyddu ar hyd y bariau graean yn destun pryder a dylid ystyried ffensio rhai ohonynt er mwyn gwarchod ffawna infertebratau graean.

Mae'r chwilen *T. newberyi* yn nodwedd o Safle o Ddiddordeb Gwyddonol Arbennig Gro Ty'n-yr-Helyg ar yr afon Ystwyth a Safle o Ddiddordeb Gwyddonol Arbennig Gro a Merddyfroedd Rheidol ar Afon Rheidol. Yn y safle gwreiddiol ar Afon Ystwyth, Gro Ty'n-yr-helyg, mae cwrs yr afon wedi newid i gael gwared ar y rhan fwyaf o'r hen far. Mae gwaddod addas wedi'i ollwng ymhellach i lawr yr afon, ond mae hyn yn llawer llai o ran maint nag yr oedd yn flaenorol. Ar Afon Rheidol, nid yw safle gwreiddiol y cofnodion yn y 1990au yn addas mwyach gan fod ffen helyg trwchus wedi sefydlu ar

draws yr ardal gyfan. Cafodd ymdrechion i gyrraedd bariau graean eraill ar y gorlifdir eu rhwystro gan ddŵr dwfn neu brysgwydd trwchus ac roedd gan yr unig far a archwiliwyd, yn Abercwmdolau, lwyth silt uchel yn y gwaddod, tra bod angen tywod glân neu raean mân ar y rhywogaeth yn ôl y sôn. Ni chafwyd hyd i unrhyw enghreifftiau o'r rhywogaeth darged yn dilyn chwiliadau â llaw a chloddio ar y ddwy afon, ond mae hon yn rhywogaeth anodd iawn i'w chanfod ac ni ddylid ystyried bod ei habsenoldeb o'r arolwg hwn yn dystiolaeth ei bod wedi darfod. Mae cyflwr presennol Afon Rheidol yn destun pryder ond efallai y bydd digwyddiadau llifogydd yn y dyfodol yn ail-weithio'r gwaddodion i greu bariau newydd. Ar Afon Ystwyth, dylid archwilio safleoedd posib i fyny ac i lawr yr afon o Ty'n-yr-helyg er mwyn asesu eu potensial ar gyfer infertebratau graean.

2. Executive Summary

The three species selected for this contract are all Individually Qualifying Features on their respective SSSIs, yet they had not been recorded on those SSSIs for at least twenty years. There is no evidence that *Anthonomus conspersus* or *Aulacobaris lepidii* had been looked for in the intervening period and although there was some survey effort in 2004 which could have yielded records of *Thinobius newberyi*, this is a difficult species to find. With habitat conditions for all three ostensibly remaining suitable there was no reason to suppose that any of their populations had become extinct. Over such a long period, however, confirmation of their continued presence is clearly desirable.

The rowan weevil *A. conspersus* was found to be strongly established at Coed Boch y rhaeadr in Migneint-Arenig-Dduallt SSSI, with adults recorded throughout the wood and on the adjacent ffridd. Historically the area was probably managed as pasture woodland and numerous ancient rowan trees are scattered throughout the more densely wooded parts of the site, as well as the open hillside. A detailed survey of the tree resource was not possible in the time available, but a rough estimate suggests that there are more than 300 trees present. A map of the denser concentrations is provided. For at least 20 years grazing stock has been fenced out of the wood as part of an agri-environment scheme and this has led to an increase in birch scrub on the lower slopes. At present there are sufficient clearings to provide suitable conditions for *A. conspersus* but consideration should be given to some management to retain these open spaces in the wood.

The yellow crucifer weevil *A. lepidii* was recorded twice on the Dee Meanders in Afon Dyfrdwy (River Dee) SSSI in the 1990s but has not been seen since. Five sites were selected for survey from aerial photographs where exposed sand and gravel was obvious on the riverbanks, as *A. lepidii* breeds in the roots of crucifers growing in sandy sediments. A further two sites were visited that had been identified as containing potential habitat during a previous survey. The species was not found during any of these surveys and vegetational succession had taken place at both of the recommended sites such that little or no exposed sand was seen. Hostplants of the weevil were generally scarce on the remaining sites and at four of the five trampling by livestock was noticeable, with the hostplant crucifers being heavily grazed. It is probable that *A. lepidii* still occurs along this stretch of river but the

disturbance to the shingle bars is a concern and consideration should be given to fencing some of them to give protection to the shingle invertebrate fauna.

The shingle rove beetle *T. newberyi* is a feature of Gro Ty'n yr Helyg SSSI on the Ystwyth and Rheidol Shingles & Backwaters SSSI on the Rheidol. At the original site on the Afon Ystwyth, Gro Ty'n-yr-helyg, the river has altered course to remove most of the former bar. Suitable sediment is deposited further downstream, but this is much smaller in extent than previously. On the Afon Rheidol, the original site of records in the 1990s is no longer suitable as dense willow carr has become established over the whole area. Efforts to reach other shingle bars in the floodplain were frustrated by deep water or dense scrub and the only bar investigated, at Abercwmdolau, had a high silt load in the sediment, whereas clean sand or fine gravel are thought to be required by the species. Hand-searching and excavation on both rivers failed to discover any examples of the target species, but this is a very difficult species to find and its absence from this survey should not be taken as evidence of extinction. The current state of the Rheidol is worrying but future flood events may rework sediments to create new bars. On the Ystywth, potential sites up and downstream from Ty'n-yr-helyg should be investigated to assess their potential for shingle invertebrates.

3. Introduction

This contract has been commissioned by Natural Resources Wales to provide current information on the status of three beetle species that have not been recorded from the SSSIs on which they are Individually Qualifying Features in the past twenty years. Whilst there is no reason to suppose that any of these populations have become extinct in the intervening period, natural processes will have resulted in alterations to the habitats over time and hence it is prudent to undertake periodic checks to ensure that populations of important invertebrate species remain viable. As such, these baseline surveys can provide information on which to develop longer-term monitoring programmes.

The contract specification outlined the elements of work required to fulfil this contract:

(1) A survey in May 2018 for *Anthonomus conspersus* will focus on the Boch-yr-rhaeadr area to establish its continued presence and to map the resource of rowan trees in the immediate area. The survey is likely to involve two days of fieldwork.

(2) A survey for *Aulacobaris lepidii* in summer 2018 will focus on past localities supporting the beetle on the River Dee and on stands of foodplants recorded by Boyce (2009). All current locations of the beetle and stands of foodplant should be mapped. The survey is likely to involve two days of fieldwork.

(3) A survey for *Thinobius newberyi* in summer 2018 will sample exposed riverine sediments on the Rheidol and Ystwyth which have previously supported the beetle. Searches will mostly involve visual searches and small excavations but may be augmented by pitfall trapping if NRW staff can service and sort the traps. If the current condition of the sediments at Glanyrafon on the Rheidol are unsuitable, then a wider search of sediments upstream and downstream should be undertaken e.g. Lovesgrove Nature Reserve. The survey is likely to involve two days of fieldwork.

4. *Anthonomus conspersus* at Coed Boch y Rhaeadr

4.1. Introduction

Figure 1. *Anthonomus conspersus* © Andreas Haselböck

Given the widespread British distribution of its foodplant, rowan *Sorbus aucuparia*, this weevil is apparently very localised and rarely seen, and is classified as Nationally Scarce in Britain (Hyman & Parsons 1992). The Weevil & Bark Beetle National Recording Scheme (WBBRS) holds just 24 reliable records of the species in Britain and only two of those, prior to this survey, are in the last 20 years. It is generally regarded as a northern species with a stronghold in Speyside, although this may reflect observer bias in that area of Scotland. There are a few records from north-east England that are considered reliable, but others from Devon, Surrey and Oxfordshire require confirmation as *A. conspersus* is easily confused with the ubiquitous *A. pedicularis*. Fowler (1891) gives records from South Lancashire and Worcestershire but there are no modern records from these vice-counties. Morris (1977) includes Cheshire in the known distribution on the basis of Lawson (1930), although he regards this record as ‘doubtful’ (M.G. Morris, *pers. comm*.). A worn specimen collected in Radnorshire in 1996 is plausible, but is more likely to have been *A. pedicularis*.

The chance discovery of a specimen of *A. conspersus* on rowan in Coed Boch y Rhaeadr (SH842398) in April 1991 was unexpected given the previous British records (Fig. 2). At the time it was believed that it would be found to occur more widely in north Wales, but several targeted surveys at the time failed to reveal any additional populations. As a consequence, *A. conspersus* has been selected as a Qualifying feature of Migneint-Arenig-Dduallt SSSI. There were no further records

from Wales until a single specimen was beaten off rowan in the Crawcwellt valley (SH6928) by Tristan Bantock in May 2017. This is nineteen kilometres to the south-west of Boch y Rhaeadr.

Figure 2. British distribution of *Anthonomus conspersus*
[unconfirmed records are not mapped]

Species	Site	Grid Reference	Recorder	Date	Abundance
Anthonomus conspersus	Boch-y-rhaeadr	SH842398	Adrian Fowles	27.4.1991	1
Anthonomus conspersus	Crawcwellt	SH6928	Tristan Bantock	11.5.2017	1

Table 1. Records of *A. conspersus* in Wales up to 2018

Anthonomus species develop as larvae in the buds or flowers of various plants and *A. conspersus* is entirely restricted to rowan *Sorbus aucuparia*. As with the related species *A. pedicularis* and *A. pomorum,* on hawthorn *Crataegus monogyna* and apple *Malus* sp. respectively, in Spring the female drills a hole in fresh flower buds and lays a single egg. The detailed life cycle of *A. conspersus* is unknown but it is expected to be similar to its close relatives and many ecological studies have been undertaken on the economically important pest *A. pomorum*. The larva affects the flower bud such that the petals fail to open and wither to form a shelter (the 'capped blossom', Fig. 3) within which the larva feeds for about a month before it pupates *in situ*. Pupation lasts for 2-3 weeks before the adults emerge and feed on rowan

leaves, then dispersing to seek out hibernation sites under bark and in other crevices (Miles 1923; Morris 1977, 2012; Neagu Frăsin 2015).

Figure 3. Probable ‘capped’ rowan flower in Coed Boch y Rhaeadr

4.2. Site Description

Figure 4. Boch y Rhaeadr woodland
(© Google Imagery 2018)

Boch y Rhaeadr, Meirionnydd (SH842398) is situated on the north-facing slopes of Arenig Fawr between 300 and 350 metres above sea level. It is part of the Migneint-Arenig-Dduallt SSSI. Flooding of the Afon Tryweryn valley in 1965 to create the reservoir of Llyn Celyn resulted in the loss of the eastern third of the woodland, but the wood has effectively occupied the same area for at least the last 100 years. It is classified as ancient in the Ancient Woodland Inventory and appears on the OS 25 inch 1st edition map of 1888. At that time there were no evident internal boundaries and the wood was presumably grazed as pasture woodland along with the areas of ffridd that exist today on the southern boundary. The wood was apparently fenced for stock exclusion about 20 years ago, probably in conjunction with a Tir Gofal agri-environment agreement, and the fence remains intact throughout. Sheep do, however, manage to find their way in under the fence in a few places and the presence of distinct sheep tracks in the upper part of the wood suggests that they are relatively frequent visitors.

The wood is dominated by downy birch *Betula pubescens*, with varying amounts of hazel *Corylus avellana*, rowan, willow *Salix* spp., alder *Alnus glutinosa* and hawthorn. Willow and alder are confined to flushes and stream banks whilst hawthorn is scarce on higher ground. The lower slopes are composed of dense young birch scrub but further up the slope the woodland becomes more open with many clearings and some of the rowan and birch trees here are very tall and ancient. Boulders, some of them massive, are strewn across the woodland floor (Fig. 5). The ground flora is acidic in character with abundant bilberry *Vaccinium myrtillus* and *Sphagna*, common woodrush *Luzula multiflora* and wood sorrel *Oxalis acetosella*; bracken *Pteridium aquilinum* with a little climbing corydalis *Ceratocapnos claviculata* occupies many of the clearings along with stands of bluebell *Hyacinthoides non-scripta*.

Figure 5. Flowering rowan in boulder-strewn clearing

Rowan is frequent throughout most of the higher ground of the woodland but is most abundant towards the western end and along the southern boundary. These areas are not considered to be Ancient Woodland (Fig. 6) and are presumably former ffridd that was enclosed when the stock exclusion fence was erected. Rowan is also the commonest tree species on the open ffridd of Foel Bodrenig and Moel Boch y Rhaeadr.

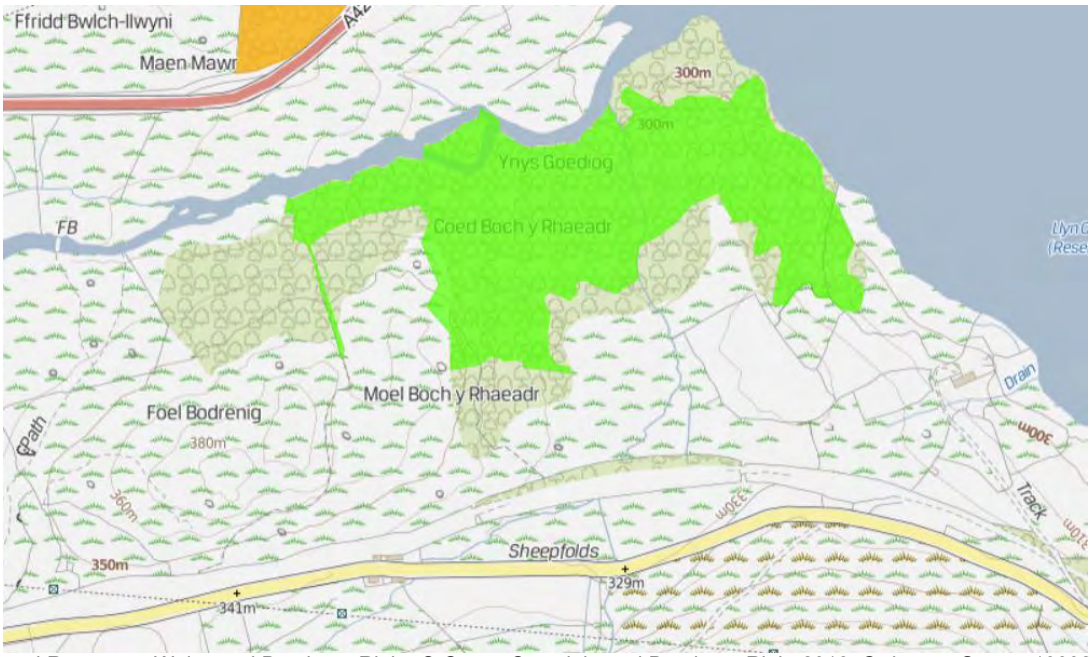

Figure 6. Ancient Woodland Inventory map for Coed Boch y Rhaeadr
[area shaded light green is considered to be Ancient Woodland]

4.3. Methods

The woodland and adjacent fridd were surveyed on 22 May and 6 June 2018. On both occasions rowan trees were located that conspicuously supported blossoms and samples were taken from a representative selection of trees within each part of the wood. Not all trees are accessible for sampling because of the occurrence of sections of steep cliff in some parts. For each sample, a standard `Bignall Pattern' beating tray (110cm x 86 cm) (Fig. 7) was held beneath blossom-bearing branches and the branch was given a sharp blow with a stick to dislodge insects from the flowers and foliage. The sudden jarring action causes insects to fall onto the tray where they can be detected. On each tree three such branches were jarred before the tray contents were examined. This produces a manageable amount of debris that can be scoured for evidence of *Anthonomus conspersus*. The weevils vary in their behaviour when they fall onto the tray: some will almost immediately begin crawling across the sheet and can be readily recognised, others (particularly if they have fallen whilst clinging onto twigs or leaves) will remain curled up and quite still, when they closely resemble rowan leaf buds. The tray contents therefore need to be carefully and thoroughly examined for signs of the weevil, a task that requires a certain amount of experience to distinguish motionless weevils from leaf buds.

For this baseline survey no attempt was made to record the characteristics of the sampled trees.

Figure 7. Sample debris on beating tray

4.4. Results

The western part of the wood was surveyed on 22 May 2018. Twenty-seven trees were sampled and 32 *Anthonomus conspersus* were recorded from 12 of these (Fig. 8). The eastern part was surveyed on 6 June 2018 and 7 *A. conspersus* were recorded on five of the 23 trees sampled (Fig. 9).

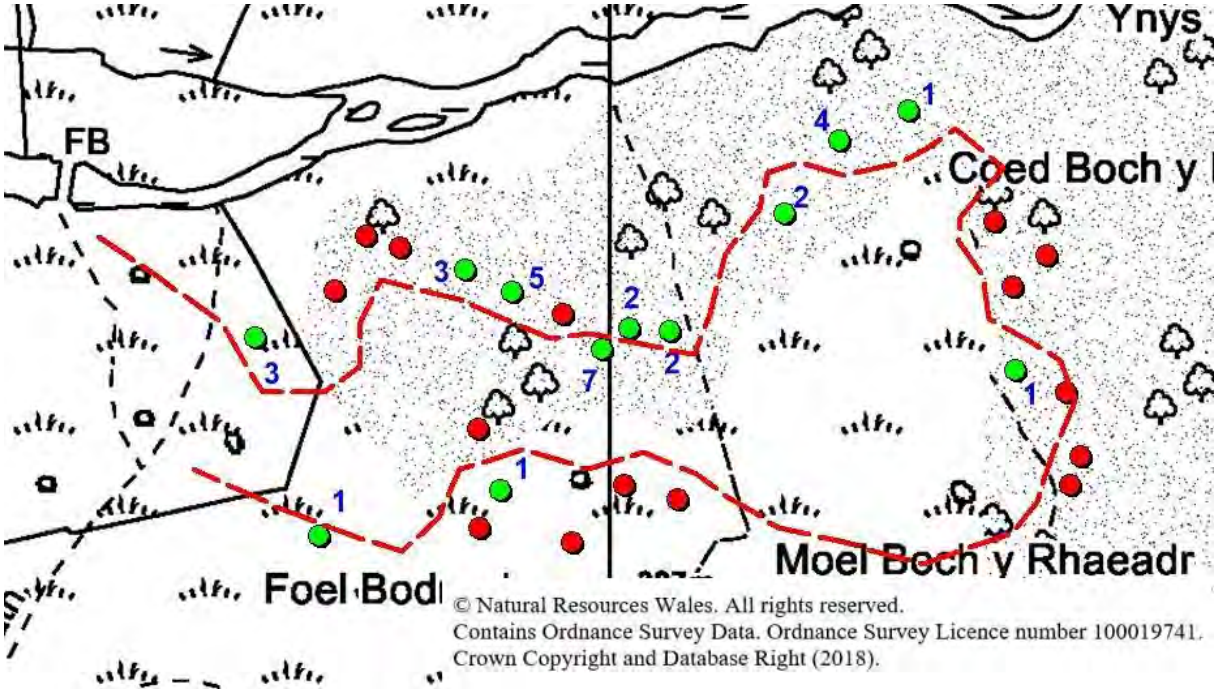

Figure 8. Sample points in western half of wood
[Green dots are positive samples with numbers of weevils recorded. Red line indicates route taken]

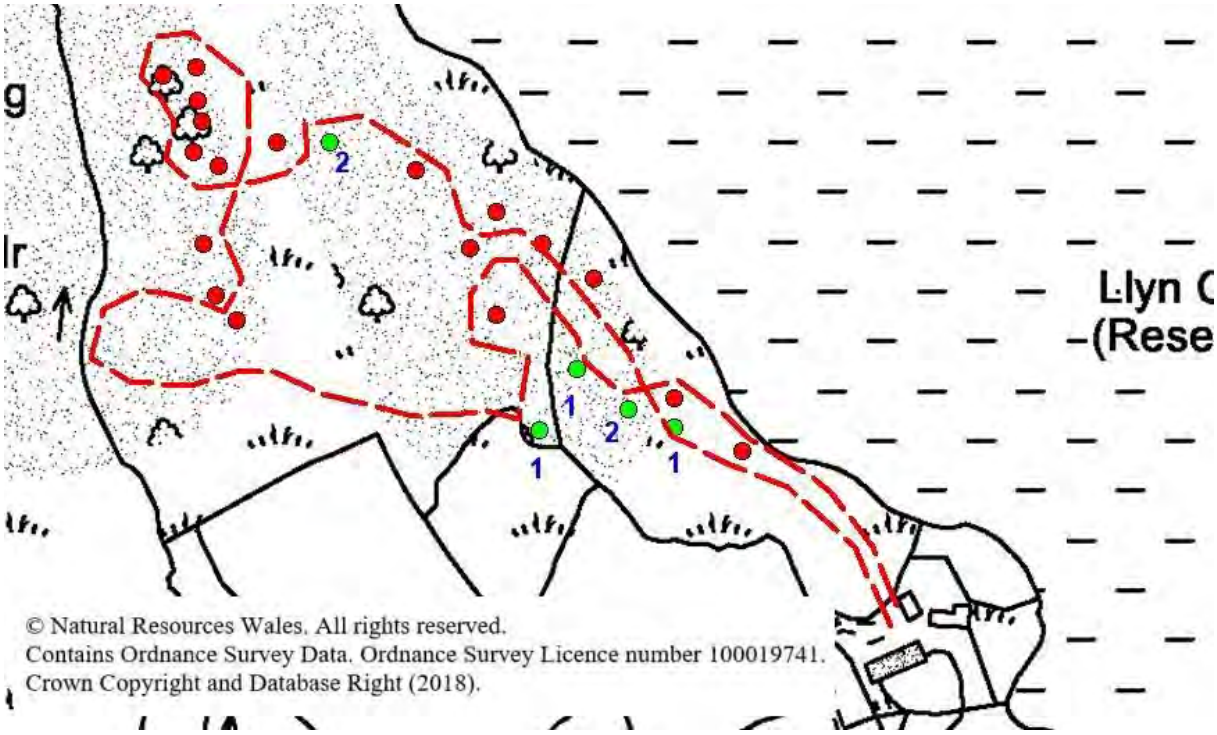

Figure 9. Sample points in eastern half of wood
[Green dots are positive samples with numbers of weevils recorded. Red line indicates route taken]

A comprehensive survey of the habitat resource in terms of the abundance of rowan trees proved not to be achievable within the time afforded to this contract. It is a large wood of approximately 10 hectares with another five hectares of ffridd containing scattered rowans. The wood is also steep in places, with vertical cliffs, and the large boulders also contribute to access difficulties. Instead areas with concentrations of rowan were roughly mapped to indicate where the *conspersus* population is likely to be most strong (Fig. 10).

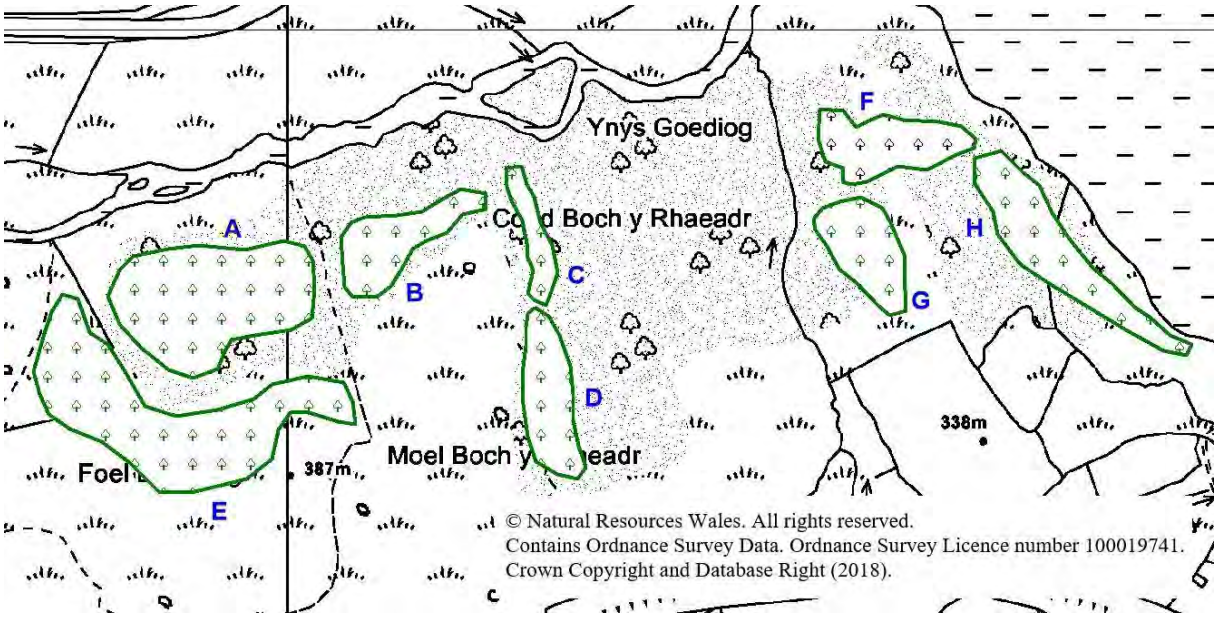

Figure 10. Concentrations of rowan trees on Boch y Rhaeadr

Zone A contains the highest density of rowan trees in the wood. It is very open in structure with grassy clearings and many mature rowans. There is some suckering

from the fallen trunks of ancient rowans but no indication of very young saplings. Tall birch trees are frequent but there is no significant evidence of seedling establishment in the acid grassland. Possibly this is an area that the sheep favour when they manage to get into the wood. It is quite probable that 100 or more rowans might occur in this zone.

Figure 11. Rowans in grassy clearing, Zone A

Zone B has a denser canopy of birch with few clearings and open ground is mainly found on the higher ground near the boundary fence. Clearings here are chiefly associated with large boulders, although there are sheep tracks along the top edge. Rowan is infrequent and mainly confined to the edges of these clearings, with a few large, mature trees buried in the birch canopy. These, however, bear little blossom. In total there may be 40 rowans here but more may be hidden within the denser part of the wood towards the river.

Zone C is a steep east-facing cliff with young birch and rowan over bilberry. This zone was not explored in detail as few of the rowans are safely accessible. I suspect there are perhaps 20-30 rowans here, but this is a very rough guess.

Zone D is an area of open boulder-strewn ffridd with ancient gnarled rowan, hawthorn and hazel. The rowan trees are mainly in full sun and most have abundant blossom. Roughly 30-40 rowans may be present.

Figure 12. Rowans on the ffridd of Moel Boch y Rhaeadr, Zone D

Zone E constitutes the ffridd on the west side of Foel Bodrenig. As with Zone D, it has frequent ancient rowans with the majority producing blossom. There appears to be an old hedge line with half a dozen mature rowan trees and there are probably another 20 or so rowans in this area, possibly more.

Figure 13. Rowans on the ffridd of Foel Bodrenig, Zone E

Zone F is the higher open ground at the top of the eastern part of the wood. There are some very large mature rowans and birches here, presumably a relict of the former wood pasture, but few open areas and hence blossom-bearing trees are scarce. The lower slopes of the wood here are covered in dense birch and evidently there are some mature rowans contained within them. I suspect that overall there are probably about 40 rowan trees in this zone, but it is difficult to tell on a brief visit.

Figure 14. Clearing with boulders in Zone F

Zone G is open acidic grassland with a scatter of tall, mature rowans. These are generally laden with blossom but much of it is in the high canopy and hence not easily accessible. About 20 rowans are present here.

Figure 15. Mature rowans in open grassland, Zone G

Zone H is effectively a continuation of Zone F in that it has the appearance of relict wood pasture with large mature birches and rowans amidst grassy glades. It is open to sheep grazing but it has more of a feel of woodland than ffridd due to the overall density and stature of the trees. Blossom-bearing rowans are scattered throughout, with something in the order of 40-50 trees likely to be present.

Figure 16. Mature birch with rowan in Zone H

Zone	Habitat type	No. of rowans
A	Open wood pasture	c. 100
B	Woodland	c.40
C	Wooded cliff	c.25
D	Open ffridd	c.35
E	Open ffridd	c.25
F	Woodland	c. 40
G	Open ffridd	c. 20
H	Wood pasture	c. 45
Total:		**c. 330**

Table 2. Estimates of rowan abundance at Boch y Rhaeadr

4.5. Discussion

Anthonomus conspersus is clearly widespread in Coed Boch y Rhaeadr and the abundance of rowan trees in the wood and adjacent ffridd suggests that its long-term future is secure. However, the distribution of rowan in the woodland is patchy, with the highest density of trees apparently in areas that were formerly ffridd before enclosure about twenty years ago. It is also noticeable that rowan flowers more profusely within and on the edge of clearings in the enclosed woodland and trees embedded within denser woodland have conspicuously fewer blossoms. This may have implications long-term as birch scrub, which is currently very dense on the lower slopes of the wood, encroaches onto clearings. It is possible that the substrate of large boulders in many areas, coupled with occasional sheep ingress, limits scrub encroachment and may maintain open clearings for a considerable time, but this should be monitored.

The two survey dates were separated by fifteen days and in this time the rowan blossoms had opened and in places were starting to go over. This may have had an impact on the sampling results, with fewer weevils located in the eastern part of the wood. Similarly, the vertical distribution of weevils is not known and possibly they are more frequent higher in the canopy.

Developing a monitoring strategy that reliably indicated the condition of the population would be difficult, but sampling early in the flowering season (which will vary in relation to Spring) would be advisable. For the related species *A. pomorum*, a pest in apple orchards, the Agriculture & Horticulture Development Board advice is to take 50 samples by beating single branches, with the presence of five weevils in total indicating an outbreak of economic significance. In this survey of *A. conspersus*, fifty trees (approximating to 150 branches) were sampled and 39 weevils were recorded. This might form a baseline for future monitoring, although the caveat regarding the timing of samples in relation to the stage of flowering will need to be considered.

Monitoring the condition of the habitat resource would not be straightforward. Rowan is distributed widely throughout the Boch y Rhaeadr property, including many fine trees between the disused railway line and the minor road. In the woodland of Coed

Boch y Rhaeadr there are areas with a relatively high density of rowans (especially in the western part), but there are scattered trees across the wood and not all of them are readily accessible, particularly on the east-facing cliff in the centre of the wood. The suggestion from my rough estimates is that there may be c.330 rowan trees in the wood and on the adjacent ffridd, but this is very approximate and feasibly there could be far more. However, not all of them flower and blossoms are absolutely crucial to the life-cycle of *A. conspersus*.

Evidence from this brief survey also suggests that *conspersus* is scarcer in the open ffridd than in open areas within the wood. Possibly this is due to the dispersal and over-wintering behaviour of the weevils as the related *A. pomorum* is known to move only short distances from their hibernation sites to find apple blossom on which to oviposit (Toepfer, 1999). As the woodland will provide abundant over-wintering sites, whereas the ffridd may be very exposed, it is plausible that rowans on the ffridd may be sub-optimal breeding sites. Again with regard to *A. pomorum*, Fowler (1891) comments that "*as the weevil never attacks the buds after they have begun to open, those orchards that have plenty of light and air, and in which the buds rapidly expand, are less likely to suffer*". A similar situation may occur on the ffridd.

My recommendation, therefore, would be to define criteria for rowans in blossom within sheltered clearings in the wood and undertake periodic (5-10 years?) surveys to ensure that the number of trees, in what may be optimal situations, is maintained. This is based on supposition, but without detailed ecological studies on the life-cycle of *A. conspersus* it seems to be a reasonable approach to take. Monitoring could be based on a selection of open areas with rowans on the margins and if it is shown that birch etc. is encroaching than the margins could be manually cut back to free flowering rowans.

5. *Aulacobaris lepidii* on the River Dee

5.1. Introduction

Figure 17. *Aulacobaris lepidii* © Boris Loboda

Aulacobaris lepidii is associated with a wide range of crucifers in Europe, however, its general scarcity in Britain means that little ecological information is available from this country. Records submitted to the Weevil & Bark Beetle Recording Scheme refer to Watercress *Nasturtium officinale*, Wintercress *Barbarea vulgaris*, Black Mustard *Brassica nigra* and Smith's Pepperwort *Lepidium heterophyllum* as possible hosts, where the adult weevils are usually found close to the roots. The discovery of an infestation of Horseradish *Armoracia rusticana* crops by *A. lepidii* in Illinois in 1978 (Bouseman *et al*. 1978) led to some ecological studies. Relevant points include the observation that overwintering was primarily in the egg or adult stages; that the larvae tunnelled extensively through the roots; that few adults were capable of flight and hence dispersal was mainly by adults wandering across the ground (Eastman 1998); and that soil coring directly over the root was the most productive way of locating adults (Sherrod *et al*. 1984).

Although widely distributed across Europe, where it is occasionally reported as a pest of crucifer crops, *A. lepidii* is Nationally Scarce in Britain (Hyman & Parsons 1992) and predominately eastern in distribution, up to the Humber. (Fig. 18). Most records are from the sandy banks of rivers but it has also been recorded in other habitats that are not far from water, including coastal sites in Hampshire. Several records are from flood debris on riverbanks in the autumn and as such it has been recorded in every month except January. The majority of British records, however, are from May-August.

Figure 18. British distribution of *Aulacobaris lepidii*

In the last 20 years it has been recorded in Britain on 17 occasions from 14 different sites, two of which are in Wales. It was first discovered here in September 1997 at Dongray Hall during a survey of river shingle invertebrates on the Dee (Sadler & Petts 2007). In June the following year three adults were found beneath crucifer rosettes on the banks of the Dee at Wern (pers. obs.). As a consequence, it has been selected as a Qualifying feature of Afon Dyfrdwy (River Dee) SSSI. The weevil has also been reported on two occasions (October 2004 & October 2005) from flood debris at Llanymynech, not far from the Afon Vyrnwy (W. Schaefer, pers. comm.) [Table 3]. It was not found during a survey of the Dee in 2008 although some of the areas supporting the foodplant were mapped (Boyce 2009).

Species	Site	Grid Reference	Recorder	Date	Abundance
Aulacobaris lepidii	River Dee, Dongray Hall	SJ401467	Jon Sadler	4.9.1997	1 adult
Aulacobaris lepidii	River Dee, Wern	SJ412472	Adrian Fowles	19.6.1998	3 adults
Aulacobaris lepidii	River Vyrnwy, Llanymynech	SJ266205	Wolfgang Schaefer	28.10.2004	2 adults
Aulacobaris lepidii	River Vyrnwy, Llanymynech	SJ266205	Wolfgang Schaefer	25.10.2005	

Table 3. Records of *A. lepidii* in Wales up to 2018

5.2. Site Description

Figure 19. The Dee meanders
(© Google Imagery 2018)

The floodplain of the Lower Dee between Holt and Worthenbury is recognised as being of national importance geomorphologically for its meanders, palaeochannels and associated landform features (Gregory 1997). It is notified as part of the Afon Dyfrdwy (River Dee) SSSI. The river channel here is 18 kilometres long and winds through open farmland, most of which is pasture, as it cuts through Ordovician and Silurian siltstones and mudstones. There are at least sixteen major meanders and many of these have associated point bars of sand and fine gravels (*ibid*.).

On the Dee the suspected hostplants for *A. lepidii* are Black Mustard and Wintercress, although Creeping Yellow Cress *Rorippa sylvestris* is also a potential host. All three of these crucifers are plants of moist, disturbed ground and are characteristically found on river banks with exposures of fine sediment. The point bars and eroded river margins of the Dee should provide suitable habitat in abundance for all three but trampling and grazing by livestock is detrimental and rank vegetation growth on stabilised sections of the river out competes these ruderal species. Research in the 1990s (Gurnell 1994; Gurnell *et al*. 1994) showed that river regulation since the 1920s (from the dams at the Alwen Reservoir, Llyn Celyn and Llyn Tegid) had caused a reduction in channel width as a result of vegetation becoming established on the banks. A detailed study of the amount and distribution of exposed sediment deposits in the Dee (Brewer *et al*. 2006) between 1946 and 1992 demonstrated that there had been a 79.9% reduction on the Dee over that period. This loss, which was the largest decline of any of the 48 Welsh catchments studied, was believed to be mainly due to changes in flow dynamics, with vegetation cover on bars increasing substantially.

5.3. Methods

Aerial photographs were consulted to identify areas of eroded riverbank and point bars that potentially could support hostplants for the weevil. Sites were visited on 22 and 25 June 2018 and the riverbank was walked between Dongray Hall and Wern (North) to check if any suitable habitats occurred between the chosen locations. All point bars were examined to check if crucifer rosettes were present and in established vegetation the conspicuous yellow flowers of the host plants were looked for.

When suitable hostplants were found they were sampled by tapping over a white tray to see if any weevils were amongst the flowers and foliage, then any rosettes were lifted to check if weevils were sheltering beneath. In such situations the top layer of soil was disturbed by fingertip to attempt to locate weevils. At Wern (North) and Shocklach Green soil was removed from around the roots of *Brassica nigra* plants and sieved over a white tray. Soil was dug out around the root to a depth of approximately 10 centimetres and placed in a kitchen sieve (Fig. 20a). This was then shaken over a white tray such that the fine sediment formed a shallow layer in which any *A. lepidii* could be easily seen (Fig. 20b). This was repeated until all of the fine sediment had been shaken through and then the remaining coarser soil particles were tipped onto the tray and examined (Fig. 20c).

Figure 20. Sieving soil sample around roots of Black Mustard

5.4. Results

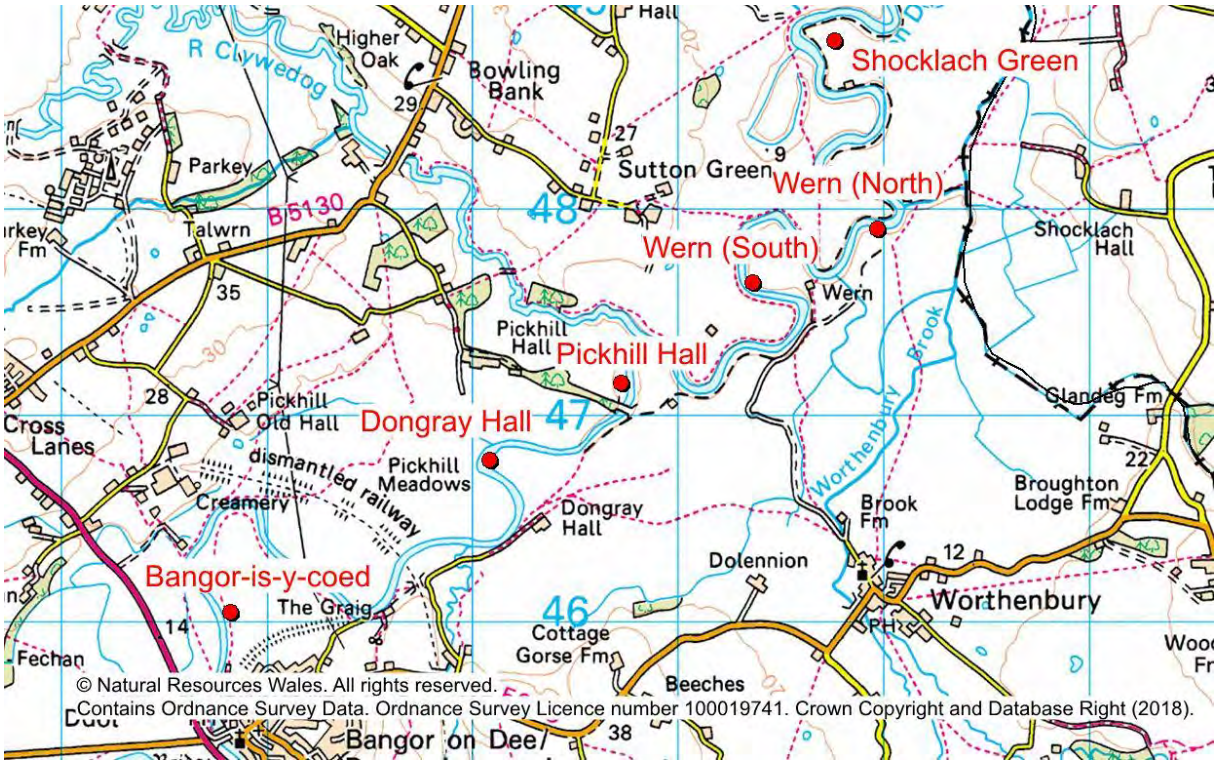

Figure 21. Location of southernmost sample sites

Seven locations were visited during the course of the survey, six of them in the southern part of the Holt-Worthenbury reach, plus the western bank of the Dee to the north of Holt Bridge.

Bangor-is-y-coed (SJ388459)

Figure 22. Riverbank cliff at Bangor-is-y-coed

This site, on the east bank of the river, was identified by Boyce (2009) as supporting extensive stands of hostplant in 2008. When Boyce undertook his survey this section was evidently much more open than it is today and aerial photos from June 2009 show the banks as being heavily eroded. Today there is almost no open ground present and instead the bank is a steep slope, fenced off from the sheep pasture above, with rank vegetation and a high cover of alder and willow bushes. A single tall plant of *Brassica nigra* was found but this was not in a safely accessible position for sampling.

Dongray Hall (SJ400467)

Figure 23. Point bar at Dongray Hall

This is a point bar of gravel and small pebbles on the east bank. It is accessed by cattle from the adjacent pasture, although the farmer at Dongray said they were kept out by electric fencing apart from 5-6 days each summer when they came down to the water to drink. As such the bar is not as heavily trampled as others on this stretch of the Dee, but nonetheless the ruderal vegetation on the bar was grazed short at the time of my visit. At the southern end a deep hollow had a few small plants of *Rorippa sylvestris*, perhaps ten in total on the steep east-facing side. These were tapped, but no *A. lepidii* were present although three examples of the crucifer-feeding weevil *Ceutorhynchus typhae* were recorded.

Pickhill Hall (SJ407471)

Figure 24. Side bars at Pickhill Hall

A large gravel bar on the west bank backed by low earth cliffs. The whole area is heavily trampled by cattle with only small patches of grassy vegetation surviving on higher levels. At the northern end the steep cliffs on the river margin do have a few clumps of *Rorippa sylvestris*. These are not accessible for sampling but may support *A. lepidii*, though without rosettes they may not be suitable. Jutting out from the east bank is another gravel bar that is grazed by sheep and has a low sward of grass in its centre, but there is no evidence of hostplants for *A. lepidii*.

Wern (South) (SJ413477)

Figure 25. River margin at Wern (South)

The river meanders here to almost come full circle. The northern stretch is very heavily cattle-trampled and is little more than mud and disturbed gravels over most of its length. The cattle also have access to the south and west sides of this area, but to get there they have to descend a steep bank and hence they favour the more shallow slopes of the northern part. In the south-west corner there is a gravel point bar that is quite trampled but it does support a diverse ruderal vegetation community. This contains perhaps 50 Black Mustard *Brassica nigra* plants as low, grazed rosettes in several clumps. These were examined by sifting beneath the rosettes and soil was removed from around five of the roots, but no *A. lepidii* were found. The crucifer-feeding weevils *Ceutorhynchus contractus* and *C. typhae* were present, however.

Wern (North) (SJ419479)

Figure 26. Vegetated banks at Wern (North)

This section of the river has tall, steep banks that are densely vegetated. In three places along the edge of this pasture there are substantial stands of *Brassica nigra*, but they consist of very tall plants embedded amongst rank vegetation. The northernmost of these was sampled without success and it is unlikely that they support *A. lepidii* as the plants are under deep shade on a clayey soil.

Shocklach Green (SJ416488)

Figure 27. Point bar at Shocklach Green

The loop of the river here has considerable potential to support a strong population of *A. lepidii* but most of the habitat is in poor condition. The adjacent pastures are cattle-grazed and the livestock have full access to the banks. As such the bars and river margins are heavily trampled and where the river is bounded by a cliff the cattle graze as high as they can. The shingle bars at each corner of the loop are extensively damaged by cattle, with the substrate churned and little or no vegetation evident. *Brassica nigra* is widely distributed along the western boundary, but the plants are largely confined to vertical cliff faces out of reach of grazing animals. In a few places there are small embayments in the cliff that have been in place since 2005 at least. These are unstable landslips, receiving less grazing and trampling pressure, and support numerous plants of *B. nigra*. The southernmost of these is inaccessible to livestock and has an abundance of *B. nigra* plants, demonstrating what the habitat could be like if cattle were excluded.

Accessible plants all along the western boundary were shaken over a sampling tray, but only a few examples of *Ceutorhynchus contractus* present. Ten soil samples were taken from the landslips towards the north-west corner, but no *A. lepidii* were found.

Holt (SJ408545)

Figure 28. Vegetated bank at Holt

Reported by Boyce (2009) as supporting an extensive stand of hostplant crucifers in 2008, the riverbank here is now smothered in dense vegetation of nettles *Urtica dioica*, docks *Rumex* sp. and reed canary-grass *Phalaris arundinacea*. In a few places there are a small number of plants of *Brassica nigra*, but these grow amongst rank vegetation and their roots are heavily shaded. Plants were sampled at each clump, with small numbers of *Ceutorhynchus contractus* recorded, and two soil samples were taken, but no *A. lepidii* were found.

5.5. Discussion

Comparing historic OS maps, Gurnell (1997) concluded that the river channel between Holt and Worthenbury had maintained more or less the same position for at least a hundred years, which is unexpected on the floodplain of a dynamic river, implying that regulation is not entirely to blame. Whatever the cause, it's certainly the case that exposed riverine sediments (ERS) are less abundant than might be expected on this stretch of river and hence the possible foodplants for *A. lepidii* are localised. Unfortunately the open access grazing livestock have to the point bars further limits the availability of suitable habitat. This creates a situation where management to optimise breeding habitat for *A. lepidii* is not easy to resolve. Reductions in flow magnitude and frequency encourage rank vegetation to establish where livestock are excluded, yet allowing grazing and trampling on ERS causes significant damage and appears to cause the loss of potential hostplants.

Given that there are relatively few point bars I would recommend that at least a proportion of these are fenced off, perhaps by the use of electric fencing (which is widely used on the floodplain pastures). Farmers will undoubtedly want their cattle to have access to water but with careful positioning of fencing it should be possible to keep cattle off at least some of the bars. The priorities would be Dongray Hall, Wern (South) and Shocklach Green.

Despite the lack of success in this survey I suspect *A. lepidii* is still present along the Dee Meanders. It is a difficult species to detect by casual survey and as we do not have a clear understanding of phenology in Britain it is possible that the survey was conducted when the over-wintering cohort of adults had died off and larvae were still in the crucifer roots. A survey in May might have greater success, or possibly later in the summer when the new generation has emerged. The latter, however, runs the risk of the riverbanks not being accessible due to high water levels. Sampling flood debris in the autumn might be another technique to employ, although that would be very unpredictable and vast amounts of debris might have to be sieved to find any adults.

If further surveys are considered then the results of this survey suggest that other potential sites might be worth exploring. The densest populations of Black Mustard were found on landslips at Shocklach Green (Fig. 29). Their gradient and unstable nature appears to dissuade cattle from spending too much time grazing there and hence some plants can become established.

Figure 29. Landslip at Shocklach Green with Black Mustard

These landslips seem to have been in place for several years and examination of aerial photographs to locate others along the river would be worthwhile. For instance, there seems to be a series of landslips similar to those at Shocklach Green on the

meanders opposite Park Farm (around SJ419513). They do not appear to be heavily trampled and hence may support populations of foodplant (Figs. 30 & 31). It should be borne in mind that these slopes, whilst only being 3 or 4 metres tall above the river, are inherently unstable and it can be difficult to maintain footing when examining plants.

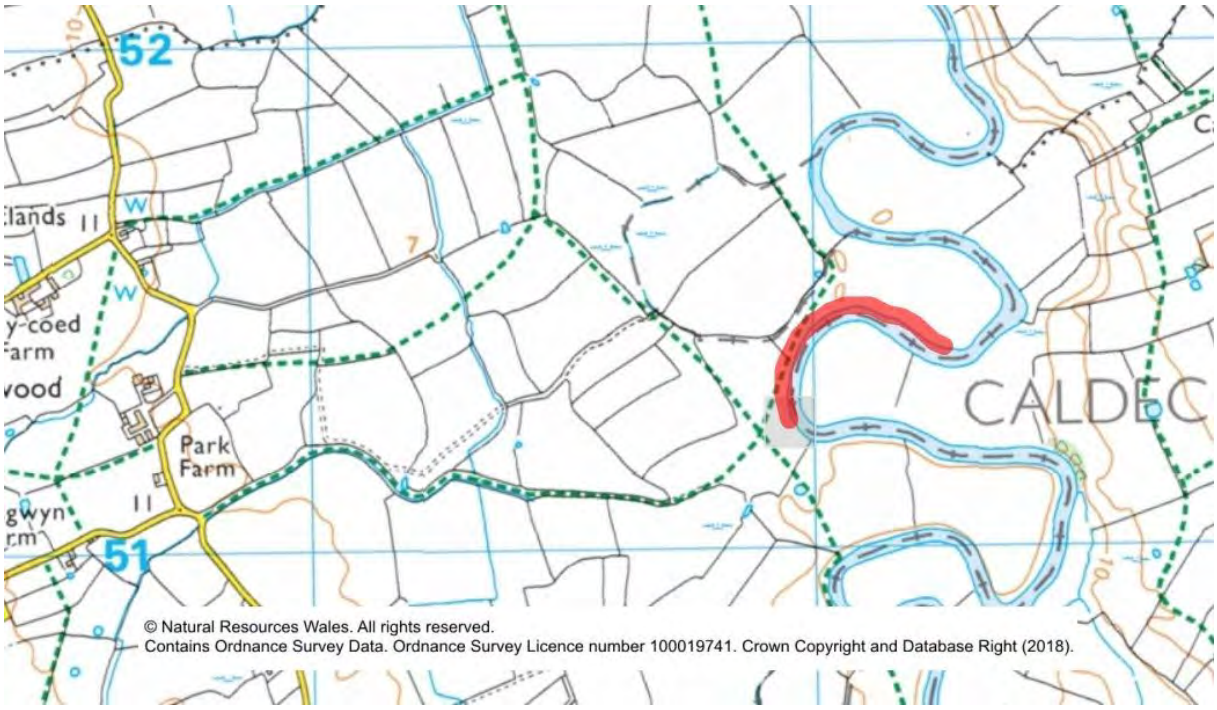

Figure 30. Potential site for future survey effort at Park Farm

Figure 31. Landslips on meander at Park Farm
(© Google Imagery 2018)

6. *Thinobius newberyi* on the Afon Rheidol and the Afon Ystywth

6.1. Introduction

Thinobius is a large world-wide genus of oxyteline Staphylinidae, the vast majority of which occur within damp sediments on the banks of water bodies, mainly amongst sand or fine gravels at the edge of rivers (Janák & Makranczy 2016). Although very little is known of their ecology, it is suspected that most species feed on decaying plant material or algae in sparsely vegetated sediments (Hammond 1998). Amongst the known British species, *T. newberyi* is unique in its combination of pale pigmentation and small eyes, suggestive of a subterranean existence (Lott 2009). So far, *T. newberyi* has not been found outside Britain, even though there has been increasing attention paid to the study of the beetles of exposed riverine sediments (ERS) across Europe over the past 35 years or so. Hammond (1996) considers it possible that *newberyi* will be discovered somewhere on the adjacent continent, but until then it is regarded as one of a very small group of insect species that are endemic to Britain.

T. newberyi was first discovered on the shingle banks of the River Eden at Great Salkeld in Cumbria in 1907 (Britten 1909), with several specimens collected under stones at this locality between then and 1911. Ten specimens in Manchester Museum (Cooter 2017) from Great Salkeld on 13/05/1904 were presumably not recognised at the time Newbery presented his description of the species as new to science (Newbery 1909). Allen (1940) reported its discovery in Scotland at Aviemore on the banks of the River Druie (two specimens) on 18 July 1938 by Peter Harwood, who also collected at least eight more specimens from the River Nethy between 21 and 27 July 1938 (Cooter 2017). Cooter's collection contains a specimen given to him by Horace Last that was collected by Peter Harwood on the River Dunlain at Carrbridge on 10 July 1923, presumably also not recognised until much later.

It was recorded in Wales for the first time on the Afon Ystwyth at Ty'n-yr-helyg, with two specimens caught in pitfall traps set between the 20 June & 18 July 1987, and on 27 August 1988 five examples were found by digging in fine gravels (Fowles 1989). At Glanyrafon on the Afon Rheidol one specimen was recorded on 2 Oct 1988 by excavating fine gravel (Fowles & Boyce 1992) and on 1 July 1990 Jonathan Cooter discovered two here amongst fine roots underneath a stone (Cooter 2017). Sadler & Bell (2002) captured 3 specimens by pitfall trapping on the Afon Tywi at Llanwrda between 26 May and 23 June 1998. An extensive survey by Lott (2004), including pitfall trapping, of all of the major shingle bars within the Afon Rheidol Shingles and Backwaters SSSI failed to locate *T. newberyi*. There have been no subsequent Welsh records. It is a Qualifying feature of both Gro Ty'n yr Helyg SSSI and Rheidol Shingles & Backwaters SSSI.

In 2014 *T. newberyi* was refound in Cumbria (Hewitt 2014) when two specimens were taken in pitfall traps operated between 16 and 27 June 2014 on the River Caldew. The same recorder collected two specimens in soil emergence traps on the River Irthing that were in situ from 12/06-07/07/2016 and 18-26/07/2016. A further

specimen was taken by the same method between 03-12/07/2016 on the River Tummel in Perthshire (Hewitt 2017). Most British records are from July but extend from mid-May to early October.

T. newberyi is an inhabitant of high-energy rivers in northern and western Britain on bars that contain a significant element of sand or fine gravel. It was given a Red Data Book status of Vulnerable by Shirt (1987), but this was amended to RDB Indeterminate by Hyman & Parsons (1994). Its conservation status will be revised in a forthcoming Species Status Review (Boyce, *in prep*.). Details of all known records are given in Appendix 1 and its British distribution is mapped in Figure 32.

Figure 32. British distribution of *Thinobius newberyi*

6.2. Site Description

Both the Ystywth and the Rheidol rise on Pumlumon in the uplands of mid Wales with a catchment of c190 km^2 and flow westwards to meet in Aberystwyth Harbour. They share similar characteristics in that they are both high-energy rivers that were severely affected by lead-mining in their upper reaches during the 18th and 19th centuries. However, the Afon Rheidol has the additional impact of flow regulation as reservoirs at Dinas and Nant-y-moch supply water to the Cwm Rheidol hydro-electric dam, which has been moderating river levels since 1962.

Afon Ystwyth

The Afon Ystwyth falls steeply for the first half of its length but from Grogwynion onwards it occupies a broader, shallow floodplain and deposits substantial amounts of gravel along much of the remaining length. Typically, these deposits are predominantly composed of coarse sediment in the higher reaches, but as the river slows sand and fine gravel become increasingly frequent in the shingle bars. A study of aerial photography for 48 Welsh rivers, comparing gravel distribution between 1946 and 1992, showed that the Ystwyth had lost 54% of its exposed sediment but only the Tywi and the Severn contained more ERS in the 1990s (Brewer *et al*. 2006).

The point bar at Ty'n-yr-helyg was the focus of research on the invertebrate fauna of river shingle in the late 1980s (Fowles 1988) and this subsequently led to its designation as Gro Ty'n-yr-helyg SSSI in recognition of its outstanding assemblage of Nationally Rare species, including *T. newberyi*. At that time the bar was largely composed of coarse pebbles (Fig. 33), but along its upper edge and towards the toe there was plenty of fine gravel and sand amongst the matrix. Behind the bar dense gorse *Ulex europaeus* scrub with abundant grass tussocks provided overwintering shelter for invertebrates.

Figure 33. Gro Ty'n-yr-helyg point bar, April 1987

Similar conditions were present ten years later when the bar was included in a national study of ERS invertebrates (Sadler & Bell 2002) and again in 2010 when it was visited as part of a national trial of ERS habitat assessment by BugLife (Hewitt *et al*. 2010) (Figs. 34 & 35).

Figure 34. Gro Ty'n-yr-helyg point bar, Sept 1997
(from Sadler & Bell 2002)

Figure 35. Gro Ty'n-yr-helyg point bar, Feb 2010
(from Hewitt *et al*. 2010)

Since then the river has changed course and cut off the point bar and tall willow scrub has now developed at the rear, dramatically reducing the amount of ERS here and depositing its sediment 100 metres further downstream in a linear bar (Fig. 36).

Figure 36. Gro Ty'n-yr-helyg point bar, May 2017
(© Google Imagery 2018)

Afon Rheidol

Significant shingle deposits are only evident on the Afon Rheidol downstream of the Cwm Rheidol dam, where the river enters a broad floodplain. The valley here contains extensive deposits of historic gravel, demonstrating how dynamic the Rheidol must have been prior to regulation. The occurrence of several gravel extraction operations in the floodplain is indicative of the extent of the resource. However, Brewer *et al*. (2006) showed that in the 1940s the Rheidol held the seventh highest amount of ERS amongst the studied rivers, by 1992 the river was ranked 11th in Wales. 78% of the ERS on the Rheidol was lost between 1951 and 1992. By contrast, the amount of shingle covered by vegetation increased from 52,502 square metres to 277,368 square metres over that time. Grimshaw & Lewin (1980) and Petts (1984) have investigated the impact that altered hydrology through flow regulation from the reservoirs has had on sedimentation within the Afon Rheidol.

The richness of the invertebrate fauna of the lower Rheidol was discovered during research in the late 1980s when the bar at Glanyrafon was extensively surveyed (Fowles 1988). Other bars in the Rheidol floodplain, including Glandwr and 'Lovesgrove Flats' (called Abercwmdolau in this survey), were also visited during the period between 1987 and 1992. *T. newberyi* was found on two occasions at Glanyrafon and at this time the bar consisted of a broad expanse of sparsely vegetated shingle with high proportion of sand and fine gravel amongst the cobbles and larger pebbles.

The bar was visited in August 2002 (Fig. 37) and although there was plenty of exposed sediment evident it was also clear that vegetation was becoming established over large areas. The national ERS habitat assessment trial (Hewitt *et al*. 2010) in 2010 showed that mature willow carr had now encroached over most of the bar (Fig. 38). The shingle that is evident in this image is a low-lying in-channel bar

whose armour layer is composed entirely of coarse pebbles. There is little topographical variation so the deposit will be submerged at high river levels and its value for the invertebrate fauna would be limited. Aerial imagery from May 2017 confirms that there is effectively no open sediment present at Glanyrafon, and in fact this is clear from aerials going back to at least 2006 (Fig 39).

Figure 37. Glanyrafon shingle bar, August 2002

Figure 38. Glanyrafon shingle bar, February 2010
(from Hewitt et al. 2010)

Figure 39. Glanyrafon, May 2017
(© Google Imagery 2018)

Examination of aerial imagery on Google Earth shows that a similar story has taken place on other bars in the Rheidol floodplain. The point bar at Glandwr has shrunken considerably over the past thirty years and the side bar at Abercwmdolau has been largely washed away as the river has moved its channel to the north, creating a few shingle islands mid-stream that lack the topographical diversity that was present in the late 1980s. It is likely, however, that a substantial shingle deposit still exists within NRW's land-holding at Lovesgrove Nature Reserve. A large area of ERS was present here in 2006 (Fig. 40) and it is still shown as being extensive in May 2017 (Fig. 41), despite some scrub encroachment.

Figure 40. Lovesgrove NRW shingle fan, 2006
(© Google Imagery 2018)

Figure 41. Lovesgrove NRW shingle fan, May 2017
(© Google Imagery 2018)

6.3. Methods

The aim of this element of the contract was to confirm the continuing presence of *T. newberyi* on Gro Ty'n-yr-helyg SSSI and the Rheidol Shingles and Backwaters SSSI. It was important, therefore, to visit the sites of past records (Ty'n-yr-helyg (SN595765) and Glanyrafon (SN614804)) to determine whether conditions still existed that were likely to support this species and aerial imagery was examined to identify other potential and accessible sites in the Rheidol floodplain. On the Rheidol the two sites that look most promising from 2017 imagery are Glandwr (SN604803) and Lovesgrove NRW (SN622809), but access permission was refused at Glandwr and it was probable that access would be difficult at Lovesgrove so the bar at Abercwmdolau (SN631808) was added to the survey.

Sites were visited on 3 & 4 August 2018. Although we know little of the ecology of *T. newberyi*, all records that state where adult specimens have been found indicate that there is an association with sparsely vegetated fine sediment of sand or gravel on the upper parts of shingle bars. There is a suggestion that it occurs amongst plant roots, where the adults may feed on algae or decaying plant material. *T. newberyi* is very small and cryptically coloured such that it can look like a small fragment of dead plant material, or indeed like a bit of plant root. All of the early (pre-1940) records in Scotland and Cumbria came from hand-searching amongst shingle, but there is no further detail to hint at methods used by these coleopterists. Since then, just one record of two individuals found under a stone on the Rheidol at Glanyrafon in 1990 emanates from hand-searching (i.e. direct observation from turning stones). The remainder are from excavation (three records), pitfall-traps (three records) and soil emergence traps (three records).

Pitfall and soil emergence trapping require a considerable investment of effort to set up, service and subsequently process the traps. Both are prone to human disturbance or trampling by livestock and may be flooded if river levels rise. Knowledge of where suitable habitat occurs in which to locate traps is also required beforehand. There was insufficient time within this contract to set up traps so effort was focused on hand-searching and excavation.

Hand searching was carried out by turning stones (generally greater than 15 square centimetres) that lay on, or were embedded in fine gravels or sand, and which were in the vicinity of sparsely distributed plants. The underside of the stone was examined for any signs of *T. newberyi* (or other shingle invertebrates) and then the matrix of plant roots on the sediment surface was examined. Because of the small size and cryptic nature of the target species this necessitates lying on the shingle bar and looking closely at the area in question. The stone was then replaced. Working across the zone of potential habitat, all suitable stones were examined until it seemed reasonable to conclude that sufficient survey had taken place (at least one hour searching).

Individual plants were also investigated by washing their roots. A selection of plants growing in fine sand or gravel were pulled up and immersed in a washing-up bowl of clean river water. The plant was shaken to disturb the sediment around the roots and then the flotsam on the meniscus was scrutinised to check for any floating invertebrates. Like several of the shingle Staphylinidae (Lott 2009), *T. newberyi* tends to float on the water surface rather than attempting to fly off, so careful examination of the scum and plant debris is needed to check for its presence.

Finally, holes were dug in the shingle bar where there was suitable habitat. Where this was close enough to the water's edge then the holes were dug to a depth to allow the water level to rise within the hole (Fig. 42). This flushes invertebrates out of the sediment and, as above, they can be sought for on the water's surface. At higher levels on the bar, the hole was dug to a depth of about 15 centimetres and the diggings were immersed into a washing-up bowl filled with river water (Fig. 43).

Figure 42. Abercwmdolau shingle excavation

Figure 43. Ty'n-yr-helyg shingle excavation

6.4. Results

Gro Ty'n-yr-helyg SSSI, SN595766

Figure 44. Point bar at Ty'n-yr-helyg, upstream view

The point bar at Ty'n-yr-helyg on the Afon Ystywth was visited on 3 August 2018. The site has changed markedly since my last visit in February 2010 and the Ystwyth has now cut through the point bar, piling up islands of shingle mid-channel towards

the south bank and leaving only a very narrow strip of coarse pebbles where the original site was. Dense willow scrub now occupies the area behind the bar (Fig. 44). Further downstream there are lateral sediment deposits extending for a 100 metres or so before this is curtailed by a new embankment. The new bar has a high content of fine gravel and is quite extensively covered by stands of water pepper *Persicaria hydropiper*, with broad-leaved docks *Rumex* sp. and a scatter of young European gorse *Ulex europaeus* bushes (Fig. 45). Other plants included small clumps of Common Hemp-nettle *Galeopsis tetrahit* and pale toadflax *Linaria repens*, and patches of sheep's sorrel *Rumex acetosella*. Towards its downstream end it is partially armoured by coarse pebbles. Beyond this there is a broad area of sand and fine gravel above bank level and behind the new embankment. From aerial imagery this appears to have been deposited in the last five years and now supports an interesting mix of vegetation over sand, but unless it is reworked by floods it will eventually scrub over. Downstream again, the river has extended the point bar on the south side of the river, but this was not examined.

Figure 45. New lateral bar at Ty'n-yr-helyg, downstream view

The search for *T. newberyi* involved 2.5 hours of stone turning, mainly along the upper edge of the lateral bar, an hour of washing plant roots, and 1.5 hours of excavation in fine gravel at the water's edge and amongst sparse vegetation on the upper levels of the bar (Fig. 45). *T. newberyi* was not found. Typically for this time of year, many of the characteristic shingle invertebrates were absent and the only staphylinid recorded was a single *Xantholinus linearis* under a log on the upper levels. However, *Bembidion atrocoeruleum* was frequent and, on the crest of the bar amongst pebbles on fine gravel and sand, the ground beetle *Lionychus quadrillum* was extremely abundant. A single example of the ground beetle *Perileptus areolatus* was seen. The specialist wolf spider *Arctosa cinerea* was common across the bar, a single female of the money spider *Caviphantes saxetorum* was found under an

embedded stone, and a few 5-spot ladybirds *Coccinella quinquepunctata* were seen. Other typical shingle species recorded were the ground beetle *Bembidion tibiale*, the click beetle *Zorochros minimus* and the bug *Cryptostemma alienum*.

Figure 46. Crest of lateral bar at Ty'n-yr-helyg with sparse grasses over fine gravel

Rheidol Shingles and Backwaters SSSI

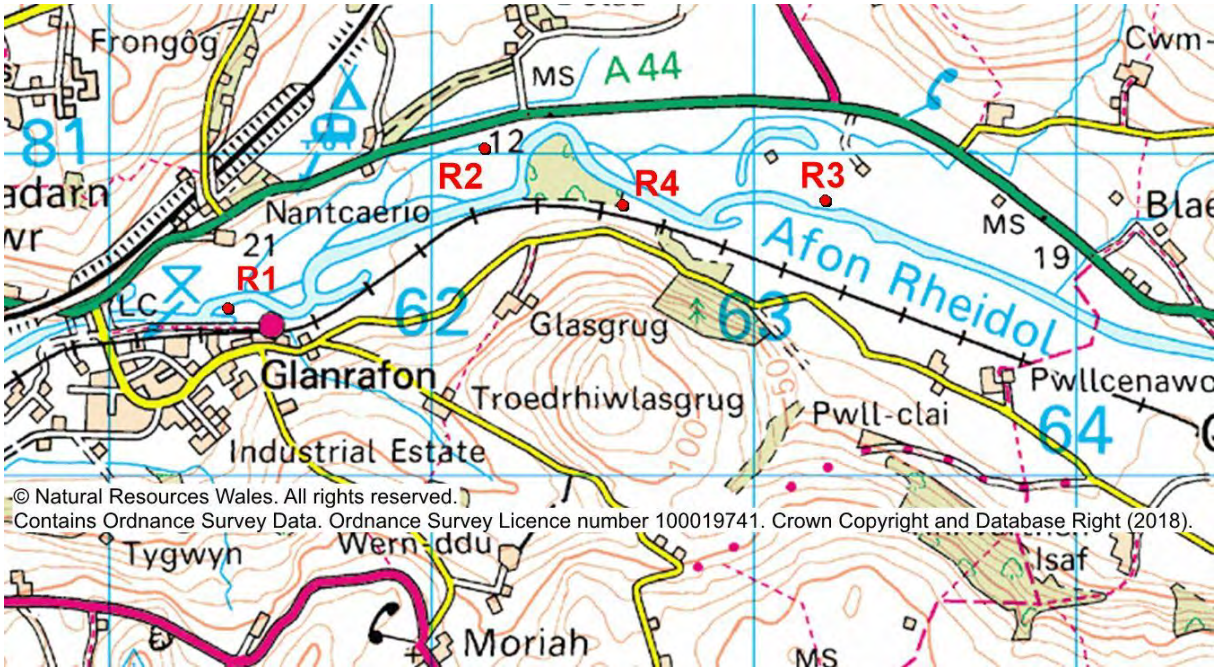

Figure 47. Location of sites surveyed on the Afon Rheidol

Glanyrafon (site R1, SN614804**)** was visited on 3 August 2018. This was the site of records of *T. newberyi* in 1988 and 1990, when the shingle bar was very open. An hour was spent following angler's paths through the wet woodland that now dominates the area but only very small patches of shingle at the river margin could be found (Fig. 48). Aerial imagery suggests that the original site became overgrown about 15 years ago and now it is extremely difficult to access the banks of the river, let alone find any ERS. No survey was carried out here and it is reasonable to conclude that *T. newberyi* no longer occurs at Glanyrafon.

Figure 48. Overgrown shingle bar at Glanyrafon

Lovesgrove Nature Reserve (site R2, SN622810**)** was visited on 4 August 2018. NRW owns an important section of the Rheidol floodplain at Lovesgrove which contains a wide range of wetland habitats, including an extensive area of ERS in the centre of the site. The aim of the visit here was to try and identify the location of the ERS, as it was not expected that access would be possible across the river channel from the north bank access points.

From the north bank it was possible to see a toe of coarse shingle on the island across the channel (Fig. 49), as well as in-stream shoals, but it was not possible to cross the river here without waders (and even that may not be safe to attempt). The bar that was visible was covered with established willow carr but aerial imagery suggests that there may be open areas of ERS behind this. As it was not possible to carry out any survey for *T. newberyi* here the wetland vegetation was briefly sampled for weevils. Stands of marsh woundwort *Stachys palustris* had conspicuous feeding damage from the nationally scarce weevil *Thamiocolus viduatus* and several adults were seen. On gipsywort *Lycopus europaeus* and water mint *Mentha aquatica* the weevil *Datonychus melanostictus* was frequent, here recorded for the first time in Cardiganshire.

Figure 49. Rheidol channel at Lovesgrove NRW

Abercwmdolau (Site R3, SN631808**)** was visited on 4 August 2018. This is a lateral bar that has generated records of several characteristic shingle invertebrates in the past, although *T. newberyi* has not been recorded here. In recent years the Rheidol has cut into the bar and created islands in-stream but there are still 100 metres or so of coarse shingle along the river margin (Fig. 50). This is quite narrow, only a couple of metres wide at most, but there is a zone of finer gravels on the crest which is partially vegetated. Downstream, at the toe, there is a flat expanse of unvegetated silt and gravel with scattered pebbles.

One hour was spent turning stones here where the habitat seemed most suitable, although the sediment is generally very coarse. The substrate also contains a high proportion of silt and little or no sand. Another half hour was spent excavating holes at the water's edge (see Fig. 42).

Figure 50. Shingle islands at Abercwmdolau

T. newberyi was, as expected, not recorded and shingle invertebrates were generally scarce. A single 5-spot ladybird *Coccinella quinquepunctata* was seen, the ground beetle *Bembidion atrocoeruleum* was frequent amongst shingle near the water, the click beetle *Zorochros minimus* was common under pebbles higher up the bar, and a single specimen of the marsh beetle *Hydrocyphon deflexicollis* was excavated from the shingle. On the riverbank behind the bar feeding damage of the scarce weevil *Thamiocolus viduatus* was widespread on marsh woundwort *Stachys palustris*.

Glasgrug (Site R4, SN623809**)** was visited on 4 August 2018. An attempt was made to gain access to the possible expanse of shingle in the centre of the Lovesgrove Nature Reserve by reaching it from the south bank of the river. The only obvious point to cross the Vale of Rheidol railway line meant entering the floodplain a kilometre or so upstream and walking through the enclosures to reach the area behind the shingle. A backwater of the river prevented access to the riverbank along this route and when the end point was reached it proved impossible to get through the dense bramble thickets to determine whether or not the shingle was accessible via this route. It is possible that other backwater channels here would have intervened even if a path could have been cut through the bramble. Despite spending an hour examining all possible entry points along the fenceline which separates the grassland from the willow carr, the attempt had to be aborted.

6.5. Discussion

It is evident from this brief survey that conditions for ERS invertebrates on the Afon Rheidol have deteriorated significantly since the last record of *T. newberyi* on the river in 1990. The regulated flow moderates flood events with the result that there is much less energy in the river (compared with pre-reservoir days) and hence sediment is not being moved around anything like it must have been in the past. The very high proportion of vegetated shingle in the floodplain in 1992 reported by Brewer *et al*. (2006) is a vivid demonstration of this and, subjectively, it appears that process has continued. Sediment will be redistributed in the system when there is a major flood event in the future, but long-term the trend is towards ongoing stabilisation.

It was also surprising to see such a high content of silt in the shingle bar at Abercwmdolau. Lott (2006) refers to the abundance of silt in 2004, but I don't recall seeing this when excavating many holes along the Rheidol in the late 1980s/early 1990s and if silt content has increased then it will encourage further stabilisation of the remaining shingle bars. Cattle were present in the river above Abercwmdolau during the survey and trampling of the river bank will not improve matters (Fig. 51). It is also evident that Himalayan balsam *Impatiens glandulifera* is now abundant along the river margin, trapping more silt and shading out what little open ERS there is left.

Figure 51. Cattle eroding riverbank above Abercwmdolau

As *T. newberyi* seems to be associated with fine sediments in the lower reaches there is clearly very little habitat left for it to occupy on the Rheidol. Perhaps there are suitable conditions on the Lovesgrove Reserve, failing that it would seem that the shingle bars at Glandwr (potentially either side of the river) are the only remaining habitat in the floodplain.

At Gro Ty'n-yr-helyg the absence of *T. newberyi* in this survey should not be taken as an indication that it is no longer present. It is an extremely difficult species to find by direct searching and, although the river has changed course dramatically, there is still plenty of potentially suitable habitat on the current bar. It is also clear from aerial imagery that the lower Ystwyth contains several other bars that may support the right conditions. Upstream from Ty'n-yr-helyg recent aerial photographs show a large fan of shingle at Henblas, with lateral bars on the opposite side of the river. Much of the fan will re-vegetate in time but a shingle bar should still remain along the river's edge.

Figure 52. Shingle fan at Henblas

Further downstream, around the village of Llanfarian, there are several bars shown on aerial photographs from 2017 that would be worth surveying. Those on the south bank at Cwmcoedwig farm appear to be trampled by cattle access from the adjoining pasture, but those on the north bank are backed by woodland and should be free from disturbance (Fig. 53). With the demise of shingle habitat on the Rheidol it is important to ensure that the river dynamics of the Ystwyth are maintained to continue to support the rich assemblage of ERS invertebrates, including the endemic rove beetle *T. newberyi*.

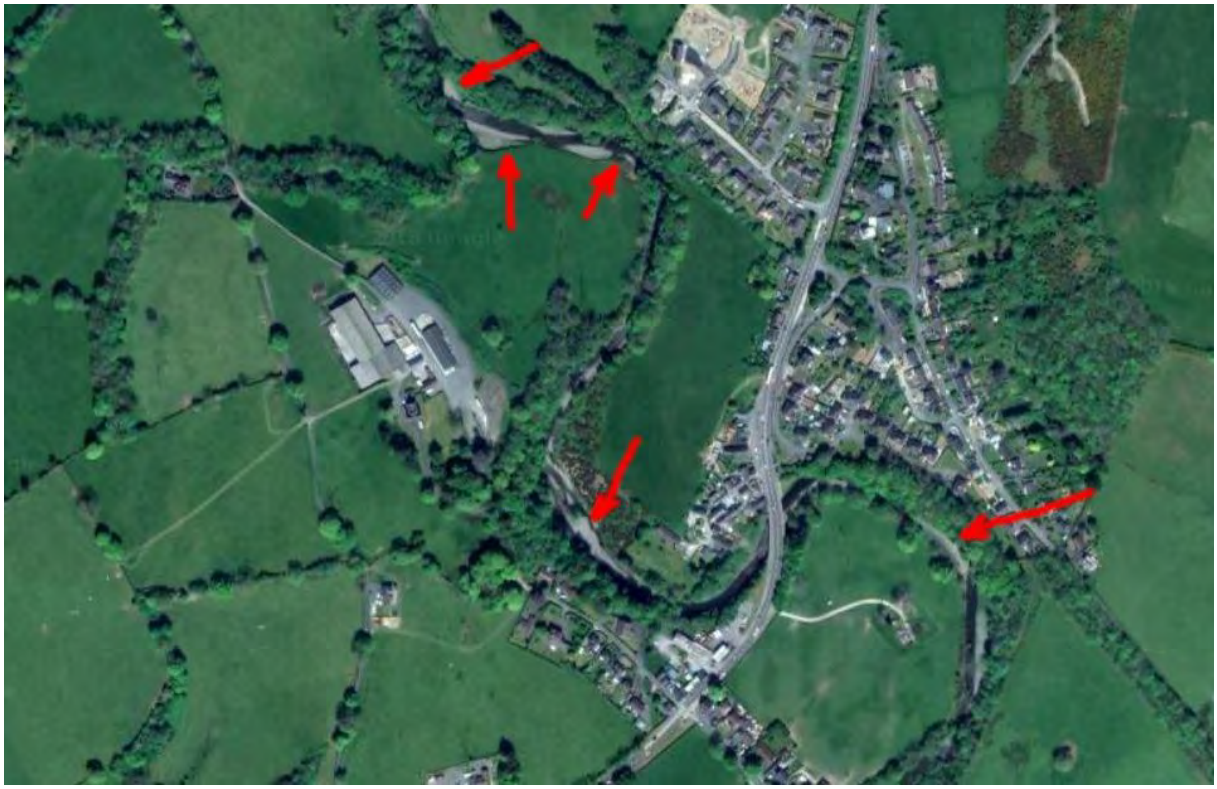

Figure 53. Shingle bars around Llanfarian

7. Acknowledgements

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9. Appendix 1: British records of *Thinobius newberyi*

Site	Grid ref	VC	Recorder	Date	Quantity	Method
Afon Tywi, Llanwrda Station	SN719309	44	Jon Sadler	23/06/1998	3	excavation
Afon Rheidol, Glanyrafon	SN614804	46	Adrian Fowles	02/10/1988	1	excavation
Afon Rheidol, Glanyrafon	SN614804	46	Jonathan Cooter	01/07/1990	2	hand-search
Afon Ystwyth, Ty'n-yr-helyg	SN595765	46	Adrian Fowles	20/06- 04/07/1987	1	pitfall
Afon Ystwyth, Ty'n-yr-helyg	SN595765	46	Adrian Fowles	04-18/07/1987	1	pitfall
Afon Ystwyth, Ty'n-yr-helyg	SN595765	46	Adrian Fowles	27/08/1988	5	excavation
River Caldew, Dalston	NY384515	70	Steve Hewitt	16-27/06/2014	2	pitfall
River Eden, Great Salkeld	NY5535	70	Harry Britten	13/05/1904	10	hand-search
River Eden, Great Salkeld	NY5535	70	Harry Britten	08/08/1907	2	hand-search
River Eden, Great Salkeld	NY5535	70	Harry Britten	31/08/1907	1	hand-search
River Eden, Great Salkeld	NY5535	70	Harry Britten	07/09/1908	4	hand-search
River Eden, Great Salkeld	NY5535	70	F.H. Day	25/06/1911	1	hand-search
River Irthing, King Water	NY525635	70	Steve Hewitt	12/06-07/07/2016	1	soil emergence
River Irthing, King Water	NY525635	70	Steve Hewitt	18-26/07/2016	1	soil emergence
Tummel Shingle Islands	NN973533	88	Steve Hewitt	03-12/07/2016	1	soil emergence
River Dunlain, Carrbridge	NH92	95	Peter Harwood	10/07/1923	1	hand-search
River Druie, Aviemore	NH91	96	Peter Harwood & A.A. Allen	18/07/1938	2	hand-search
River Nethy, Nethy Bridge	NH9010	96	Peter Harwood	21/07/1938	1	hand-search
River Nethy, Dell Hotel, Nethy Bridge	NJ0119	95	Peter Harwood	25/07/1938	4	hand-search
River Nethy, Dell Hotel, Nethy Bridge	NJ0119	95	Peter Harwood	27/07/1938	3	hand-search

10. Appendix 2: Invertebrate Records

Order	Taxon	Site	Gridref	VC	Start Date	Quantity	Comment
Coleoptera	*Anthonomus conspersus*	Coed Boch-y-rhaeadr	SH841398	48	22/05/2018	8	beaten off rowan
Coleoptera	*Anthonomus conspersus*	Coed Boch-y-rhaeadr	SH839398	48	22/05/2018	19	beaten off rowan
Coleoptera	*Gonioctena pallida*	Coed Boch-y-rhaeadr	SH839398	48	22/05/2018	5	beaten off rowan and hazel
Coleoptera	*Phyllobius glaucus*	Coed Boch-y-rhaeadr	SH839398	48	22/05/2018		several beaten off rowan etc.
Coleoptera	*Phyllobius glaucus*	Coed Boch-y-rhaeadr	SH841398	48	22/05/2018		several beaten off rowan etc.
Coleoptera	*Polydrusus pterygomalis*	Coed Boch-y-rhaeadr	SH839398	48	22/05/2018		several beaten off rowan etc.
Coleoptera	*Polydrusus pterygomalis*	Coed Boch-y-rhaeadr	SH841398	48	22/05/2018		several beaten off rowan etc.
Coleoptera	*Strophosoma melanogrammum*	Coed Boch-y-rhaeadr	SH841397	48	22/05/2018	1	beaten off rowan in ffridd
Coleoptera	*Anthonomus conspersus*	Foel Bodrenig	SH838397	48	22/05/2018	5	beaten off rowan in ffridd
Coleoptera	*Anthonomus pedicularis*	Foel Bodrenig	SH838397	48	22/05/2018	1	beaten off ancient hawthorn
Lepidoptera	*Ematurga atomaria*	Foel Bodrenig	SH837398	48	22/05/2018		several flying over heathy grassland
Coleoptera	*Anthonomus conspersus*	Coed Boch-y-rhaeadr	SH845398	48	06/06/2018	7	beaten off rowan
Coleoptera	*Athous haemorrhoidalis*	Coed Boch-y-rhaeadr	SH845398	48	06/06/2018		beaten off rowan
Coleoptera	*Athous haemorrhoidalis*	Coed Boch-y-rhaeadr	SH844398	48	06/06/2018		beaten off rowan
Coleoptera	*Byturus tomentosus*	Coed Boch-y-rhaeadr	SH845398	48	06/06/2018		beaten off rowan
Coleoptera	*Calvia 14-guttata*	Coed Boch-y-rhaeadr	SH844398	48	06/06/2018	1	beaten off rowan
Coleoptera	*Cychramus luteus*	Coed Boch-y-rhaeadr	SH844398	48	06/06/2018	1	beaten off rowan
Coleoptera	*Denticollis linearis*	Coed Boch-y-rhaeadr	SH844398	48	06/06/2018	2	beaten off rowan
Coleoptera	*Otiorhynchus singularis*	Coed Boch-y-rhaeadr	SH845398	48	06/06/2018		beaten off rowan
Coleoptera	*Phyllobius glaucus*	Coed Boch-y-rhaeadr	SH845398	48	06/06/2018		beaten off rowan
Coleoptera	*Phyllobius glaucus*	Coed Boch-y-rhaeadr	SH844398	48	06/06/2018		beaten off rowan
Coleoptera	*Polydrusus pterygomalis*	Coed Boch-y-rhaeadr	SH845398	48	06/06/2018		beaten off rowan
Coleoptera	*Polydrusus pterygomalis*	Coed Boch-y-rhaeadr	SH844398	48	06/06/2018		beaten off rowan
Coleoptera	*Rhamphus oxyacanthae*	Coed Boch-y-rhaeadr	SH844398	48	06/06/2018	1	beaten off rowan
Coleoptera	*Trachys minuta*	Coed Boch-y-rhaeadr	SH845398	48	06/06/2018	1	distinctive oviposition site on *Sorbus* leaf
Diptera	*Sericomyia silentis*	Coed Boch-y-rhaeadr	SH844398	48	06/06/2018	2	
Lepidoptera	*Coenonympha pamphilus*	Coed Boch-y-rhaeadr	SH844398	48	06/06/2018	1	
Mollusca	*Discus rotundatus*	Coed Boch-y-rhaeadr	SH845398	48	06/06/2018	1	in bracken litter
Odonata	*Pyrrhosoma nymphula*	Coed Boch-y-rhaeadr	SH844398	48	06/06/2018	1	
Coleoptera	*Nephus quadrimaculatus*	Bangor-is-y-coed	SJ387455	50	22/06/2018	2	tapped off ivy along riverside footpath
Coleoptera	*Ochina ptinoides*	Bangor-is-y-coed	SJ387455	50	22/06/2018	3	tapped off ivy along riverside footpath

Coleoptera	*Ceutorhynchus typhae*	Dongray Hall, R. Dee	SJ400467	50	22/06/2018	3	off *Rorippa* on shingle bar
Odonata	*Calopteryx splendens*	Pickhill Hall, R. Dee	SJ407470	50	22/06/2018	1	riverbank
Coleoptera	*Ceutorhynchus cochleariae*	Wern, R. Dee	SJ413477	50	22/06/2018	1	riverbank, off ruderal vegetation
Coleoptera	*Ceutorhynchus contractus*	Wern, R. Dee	SJ413477	50	22/06/2018	6	off *Brassica nigra* on shingle bank
Coleoptera	*Ceutorhynchus pallidactylus*	Wern, R. Dee	SJ413477	50	22/06/2018	2	off *Sisymbrium officinale* on riverbank
Coleoptera	*Ceutorhynchus pyrrhorhynchus*	Wern, R. Dee	SJ413477	50	22/06/2018	1	off *Sisymbrium officinale* on riverbank
Coleoptera	*Eutrichapion ervi*	Wern, R. Dee	SJ417474	50	22/06/2018	2	trackside, off *Vicia cracca*
Coleoptera	*Oxystoma craccae*	Wern, R. Dee	SJ417474	50	22/06/2018	2	trackside bank, off *Vicia cracca*
Coleoptera	*Phyllobius virideaeris*	Wern, R. Dee	SJ413477	50	22/06/2018	1	riverbank, off ruderal vegetation
Coleoptera	*Rhinocyllus conicus*	Wern, R. Dee	SJ413477	50	22/06/2018	1	riverbank, off *Cirsium arvense*
Coleoptera	*Rhinoncus pericarpius*	Wern, R. Dee	SJ413477	50	22/06/2018	1	riverbank, off ruderal vegetation
Coleoptera	*Tanymecus palliatus*	Wern, R. Dee	SJ413477	50	22/06/2018	1	riverbank, off ruderal vegetation
Lepidoptera	*Aglais urticae*	Wern, R. Dee	SJ413477	50	22/06/2018		riverbank
Lepidoptera	*Maniola jurtina*	Wern, R. Dee	SJ413477	50	22/06/2018		riverbank
Lepidoptera	*Pararge aegeria*	Wern, R. Dee	SJ417474	50	22/06/2018		hedgerow
Odonata	*Calopteryx splendens*	Wern, R. Dee	SJ419479	50	22/06/2018	1	riverbank
Coleoptera	*Ceutorhynchus contractus*	Holt, R. Dee	SJ408545	50	25/06/2018		several off *Brassica nigra* on shingle bank
Coleoptera	*Ceutorhynchus contractus*	Holt, R. Dee	SJ411543	50	25/06/2018		several under bridge on *Sisymbrium*
Coleoptera	*Ceutorhynchus pyrrhorhynchus*	Holt, R. Dee	SJ411543	50	25/06/2018	1	under bridge on *Sisymbrium*
Coleoptera	*Gastrophysa viridula*	Holt, R. Dee	SJ408545	50	25/06/2018		on riverbank docks
Lepidoptera	*Aglais urticae*	Holt, R. Dee	SJ408545	50	25/06/2018		riverbank grassland
Lepidoptera	*Maniola jurtina*	Holt, R. Dee	SJ408545	50	25/06/2018		on riverbank grassland
Coleoptera	*Bembidion tetracolum*	Shocklach Green, R. Dee	SJ416488	50	25/06/2018	1	in sandy soil on slumped riverbank cliff
Coleoptera	*Ceutorhynchus typhae*	Shocklach Green	SJ426488	50	25/06/2018	5	field edge, on *Capsella*
Coleoptera	*Microplontus rugulosus*	Shocklach Green	SJ426488	50	25/06/2018	1	field edge, on *Matricaria*
Lepidoptera	*Pararge aegeria*	Shocklach Green	SJ429488	58	25/06/2018		along green lane
Coleoptera	*Ceratapion onopordi*	Shocklach Green, R. Dee	SJ416489	50	25/06/2018	1	tapped off *Cirsium* on field margin
Coleoptera	*Ceutorhynchus contractus*	Shocklach Green, R. Dee	SJ416488	50	25/06/2018		several off *Brassica nigra* on riverbank cliff
Coleoptera	*Ceutorhynchus pyrrhorhynchus*	Shocklach Green, R. Dee	SJ416488	50	25/06/2018	1	off *Brassica nigra* on riverbank cliff
Coleoptera	*Tanymecus palliatus*	Shocklach Green, R. Dee	SJ416488	50	25/06/2018	1	off *Reseda luteola* on riverbank cliff
Araneae	*Arctosa cinerea*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		frequent in sandy areas of river shingle
Araneae	*Caviphantes saxetorum*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018	1	river shingle
Coleoptera	*Agonum albipes*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		river shingle
Coleoptera	*Bembidion atrocoeruleum*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		frequent in river shingle
Coleoptera	*Bembidion quadrimaculatum*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018	1	river shingle

Coleoptera	*Bembidion tetracolum*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		river shingle
Coleoptera	*Bembidion tibiale*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		river shingle
Coleoptera	*Cassida rubiginosa*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		river shingle
Coleoptera	*Coccinella quinquepunctata*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018	3	river shingle, plus 2 pupae under log
Coleoptera	*Coccinella septempunctata*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		river shingle
Coleoptera	*Dryops luridus*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		river shingle
Coleoptera	*Gastrophysa viridula*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		river shingle
Coleoptera	*Lionychus quadrillum*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		very common on sandy, upper levels
Coleoptera	*Perapion curtirostre*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		river shingle
Coleoptera	*Perileptus areolatus*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018	1	river shingle
Coleoptera	*Rhinoncus castor*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		river shingle
Coleoptera	*Rhizobius liturata*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		river shingle
Coleoptera	*Xantholinus linearis*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018	1	in dead branch on river shingle
Coleoptera	*Zorochros minimus*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		common in river shingle
Hemiptera	*Cryptostemma alienum*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		river shingle
Hemiptera	*Dolycoris baccarum*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		river shingle
Lepidoptera	*Pieris brassicae*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		river shingle
Lepidoptera	*Vanessa atalanta*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018		river shingle
Orthoptera	*Tetrix undulata*	Gro Ty'n-yr-helyg	SN595766	46	03/08/2018	1	river shingle
Coleoptera	*Bembidion atrocoeruleum*	Abercwmdolau, Rheidol	SN631808	46	04/08/2018		common in river shingle
Coleoptera	*Bembidion tetracolum*	Abercwmdolau, Rheidol	SN631808	46	04/08/2018		river shingle
Coleoptera	*Coccinella quinquepunctata*	Abercwmdolau, Rheidol	SN631808	46	04/08/2018	1	river shingle
Coleoptera	*Dryops luridus*	Abercwmdolau, Rheidol	SN631808	46	04/08/2018		river shingle
Coleoptera	*Gastrophysa viridula*	Abercwmdolau, Rheidol	SN631808	46	04/08/2018		river shingle
Coleoptera	*Hippodamia variegata*	Abercwmdolau, Rheidol	SN631808	46	04/08/2018	1	river shingle
Coleoptera	*Pterostichus cupreus*	Abercwmdolau, Rheidol	SN631808	46	04/08/2018	1	river shingle
Coleoptera	*Hydrocyphon deflexicollis*	Abercwmdolau, Rheidol	SN631808	46	04/08/2018	1	river shingle
Coleoptera	*Thamiocolus viduatus*	Abercwmdolau, Rheidol	SN631808	46	04/08/2018		feeding damage abundant on *Stachys palustris*
Coleoptera	*Zorochros minimus*	Abercwmdolau, Rheidol	SN631808	46	04/08/2018		common in river shingle
Lepidoptera	*Autographa gamma*	Abercwmdolau, Rheidol	SN631808	46	04/08/2018		river shingle
Lepidoptera	*Pieris brassicae*	Abercwmdolau, Rheidol	SN631808	46	04/08/2018		river shingle
Lepidoptera	*Polyommatus icarus*	Abercwmdolau, Rheidol	SN631808	46	04/08/2018		river shingle
Odonata	*Sympetrum striolatum*	Abercwmdolau, Rheidol	SN631808	46	04/08/2018		river shingle
Coleoptera	*Apion rubens*	Glasgrug, Rheidol	SN625808	46	04/08/2018	1	acid grassland, on *Rumex acetosella*
Coleoptera	*Exapion ulicis*	Glasgrug, Rheidol	SN625808	46	04/08/2018		river shingle

Coleoptera	*Perapion curtirostre*	Glasgrug, Rheidol	SN625808	46	04/08/2018	1	acid grassland, on *Rumex acetosella*
Coleoptera	*Perapion marchicum*	Glasgrug, Rheidol	SN625808	46	04/08/2018	1	acid grassland, on *Rumex acetosella*
Lepidoptera	*Coenonympha pamphilus*	Glasgrug, Rheidol	SN623809	46	04/08/2018		acid grassland
Lepidoptera	*Lasiommata megera*	Glasgrug, Rheidol	SN623809	46	04/08/2018	1	acid grassland
Lepidoptera	*Lycaena phlaes*	Glasgrug, Rheidol	SN623809	46	04/08/2018		river shingle
Lepidoptera	*Polyommatus icarus*	Glasgrug, Rheidol	SN623809	46	04/08/2018		acid grassland
Coleoptera	*Cassida flaveola*	Lovesgrove NRW, Rheidol	SN622810	46	04/08/2018		riverbank wetland
Coleoptera	*Coccidula rufa*	Lovesgrove NRW, Rheidol	SN622810	46	04/08/2018		riverbank wetland
Coleoptera	*Coleositona cambricus*	Lovesgrove NRW, Rheidol	SN622810	46	04/08/2018	2	riverbank wetland
Coleoptera	*Datonychus melanostictus*	Lovesgrove NRW, Rheidol	SN622810	46	04/08/2018	5	off *Mentha* & *Lycopus* in riverbank wetland
Coleoptera	*Hypera rumicis*	Lovesgrove NRW, Rheidol	SN622810	46	04/08/2018	1	riverbank wetland
Coleoptera	*Ischnoptera modestum*	Lovesgrove NRW, Rheidol	SN622810	46	04/08/2018		riverbank wetland, off *Lotus uliginosus*
Coleoptera	*Subcoccinella 24-punctata*	Lovesgrove NRW, Rheidol	SN622810	46	04/08/2018		river shingle
Coleoptera	*Thamiocolus viduatus*	Lovesgrove NRW, Rheidol	SN622810	46	04/08/2018	3	feeding damage abundant on *Stachys palustris*
Coleoptera	*Tytthaspis 16-punctata*	Lovesgrove NRW, Rheidol	SN622810	46	04/08/2018		riverbank wetland
Lepidoptera	*Coenonympha pamphilus*	Lovesgrove NRW, Rheidol	SN622810	46	04/08/2018		riverbank wetland
Lepidoptera	*Polyommatus icarus*	Lovesgrove NRW, Rheidol	SN622810	46	04/08/2018		riverbank wetland

11. Data Archive Appendix

The data archive contains:

[A] The final report in Microsoft Word and Adobe PDF formats.

[B] Species records, which are held on the NRW Recorder 6 database.

Metadata for this project is publicly accessible through Natural Resources Wales' Library Catalogue http://libcat.naturalresources.wales or http://catllyfr.cyfoethnaturiol.cymru by searching 'Dataset Titles'. The metadata is held as record no 121844.

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